For discussion
20 August 2021

Legislative Council Panel on Transport

Road Maintenance and Streetscape Enhancement by Highways Department

Purpose

This paper briefs Members on the enhancement measures taken by the Highways Department (HyD) in respect of road maintenance including the application of new and intelligent technologies and innovative measures such as streetscape enhancement.

Maintenance Work of Highway Facilities under HyD

2. HyD is responsible for the maintenance of public roads in Hong Kong, which covers public carriageways (including local carriageways, expressways and footpaths), highway structures (including bridges, tunnels etc.), road facilities (including road lights and street furniture such as traffic signs, roadside barriers, railings, traffic bollards etc.) as well as roadside slopes, etc.

3. Over the past years, the road network of Hong Kong has expanded rapidly. From the establishment of HyD in 1986 to mid-2021, the total length of public carriageways maintained by the department has increased from about 3 400 kilometres (km) to about 6 000 km, and the number of highway structures has increased from about 1 020 to about 4 800. In addition, HyD is also responsible for the maintenance of about 2 700 km footpaths in Hong Kong, about 250 lifts and about 90 escalators connecting to public walkways, about 240 000 public lighting facilities (including road lights, footbridge and subway lightings, traffic bollards and road sign floodlights) and about 12 500 roadside slopes.

Research, Development and Application of New Technologies in Road Maintenance

Research and Development of More Durable Bituminous Paving Materials

4. Roads wear and tear alongside daily use. There will also be damages of different extent, such as potholes or cracks on pavements, damaged traffic signs, etc. due to unforeseen circumstances including traffic accidents, vandalism, inclement weather or bursting of underground pipes etc. In light of the above, HyD carries out road maintenance works to upkeep the condition of roads and conduct regular inspections for the public roads in Hong Kong with a view to identifying locations of road defects and arranging for repair works as early as possible. Depending on various factors such as the seriousness of road defect and the traffic flow at the road section concerned, the scope and time required for the maintenance works will vary and may cause inconvenience to the public. For instance, location of road maintenance works may be close to residential area or shops, especially for roads in the urban area, or there is need for implementation of temporary traffic arrangement, etc. In view of this, HyD has been studying road paving materials that are more resistant to wear and tear so as to minimize the frequency of maintenance works of extensive scale or long works duration.

5. In collaboration with the Hong Kong Polytechnic University, HyD has researched and developed a more durable bituminous paving material – "Highly Modified Stone Mastic Asphalt". This material is composed of bitumen binder of higher viscosity and therefore has improved durability. Laboratory test results show that this new bituminous paving material has better anti-deformation, anti-aging and anti-fatigue performance than the existing bituminous materials. Site trials have been conducted since end 2018 at road sections in the urban area where there is high traffic flow and frequent road damage such as the toll plaza area of Cross Harbour Tunnel and Lung Mun Road in Tuen Mun, etc. Up to end May 2021, HyD has tested the use of this new bituminous paving material at 29 road sections with busy traffic. According to the trial outcome, the new material indeed has a better anti-deformation, anti-aging and anti-fatigue performance on site than the existing bituminous materials in

general and is considered useful in reducing road maintenance frequency. HyD is going conduct further trials on this new material at more road sections with a view to collecting further data to finalise the research findings in 2022, based on which relevant plan on the wider application of this new material will be formulated.

6. Apart from the above, HyD has also carried out research study on enhancing the durability of low noise bituminous paving materials. Although the low noise bituminous paving material currently in use can help reduce tyre noise, it soon has significant wear and tear and hence require frequent maintenance when used at road sections of steep gradient or those with frequent sharp turns or requires frequent braking. In this regard, HyD and the Hong Kong Polytechnic University have jointly developed a new low noise bituminous paving material – "Polymer Modified Stone Mastic Asphalt" with a view to strengthening low noise paving material's resistance to deterioration and thereby reducing the frequency of relevant road repairs. Since 2019, HyD has been carrying out site trials on this new low noise paving material at various types of road sections, such as stop lines, bus stops, steep roads and road sections with sharp turns, etc. As of end May 2021, HyD has already conducted trial of this new low noise paving material at 32 road sections. The trial results generally reveal that the new material has better durability than the existing low noise paving materials while maintaining similar performance in reducing tyre noise. HyD will continue to conduct trials at more road sections with a view to collecting more data to finalise the study findings.

Research, Development and Application of New Technologies to Enhance Efficiency and Safety of Maintenance Works

7. With new roads commissioning one after the other, the existing roads also begin to age. At present, HyD has about 1 500 public highway structures completed over 30 years ago under its purview, accounting for more than 30% of all public highway structures. In order to ensure the structural safety of public highway structures, HyD plans to progressively conduct comprehensive inspections on these structures, including completing the comprehensive inspection on the main structures and associated components of about 700 highway structures in the coming

three years, and carrying out the required repair works according to the inspection results. As there is substantial number of aged highway structures and the number is anticipated to be continuously increasing, the relevant maintenance works are becoming more onerous. Hence, HyD needs to enhance the efficiency of its maintenance work through application of new technologies. HyD has also been proactively adopting new technologies and equipment to support and enhance the work safety of maintenance staff.

Use of Unmanned Aerial Vehicle (UAV) for Inspection

8. After the passage of typhoons and heavy rainstorms, HyD will inspect the condition of the trees on its slopes and clear fallen trees to ensure public safety. Most of the slope areas are difficult to access and site inspection will be even more difficult if there are trees or large branches fallen on slopes. Separately, the inspection for bridge involves requiring engineers to work at height to conduct visual inspection of the bridge at close distance. UAV serves to provide engineers a safer and more convenient alternative method for site inspection without having to physically enter places which are difficult access.

9. To support the inspection and maintenance works of highway structures, HyD has purchased UAVs since 2017 for engineers to carry out inspections and take records at places which are difficult access (such as the steep roadside slope at Duckling Hill in Tseung Kwan O and the long-span Ting Kau Bridge, etc.). UAV could capture photos and videos in high resolution to facilitate engineers to assess and make detailed record of the conditions of highway structures. These photos can also be used to create images for surveying so that engineers can carry out quick graphical measurements for assessment of structural conditions of the highway structures without requiring site visit. HyD will also use UAV to take photos of its roadside slopes that are difficult to access for assessment of the conditions of trees and surveying the conditions of fallen/damaged trees after heavy rainstorms and typhoons. Compared with traditional inspections, the use of UAV can effectively enhance the efficiency and safety of road and slope inspections. HyD will regularly review the use of UAV and timely procure new machines to meet future need.

Smart Lighting Management System (SLMS)

10. Since 2017, HyD has introduced SLMS and has been conducting trials in various districts in Hong Kong. So far, about 4 000 road lights have been installed with SLMS. SLMS not only enables more efficient monitoring on the operation of the public lighting system and accurate assessment of the causes of failures by the maintenance staff, it also allows road lights to adjust its brightness automatically according to road conditions, thereby further enhancing the maintenance responsiveness and energy efficiency. SLMS could reduce the time in identifying road light failure from 24 hours or above to about 30 minutes. In addition to improving the efficiency of road light maintenance work, SLMS also enhances energy-saving efficiency of the public light system and achieves an annual saving of about $2 million in electricity expenses. In view of the above, HyD plans to gradually install SLMS for the road lights in Hong Kong in the coming six years to enhance their efficiency and service. SLMS also provides large amount of operation data, such as electricity voltage, current and illuminance to facilitate HyD to formulate maintenance plans more accurately and take preventive measures to minimise chances of road light malfunction.

Intelligent Robotic System

11. In order to enhance the safety of workers in implementing temporary traffic arrangement on high speed roads especially during night time, HyD is committed to exploring how to automate the set up and collection traffic cones and lanterns on high speed roads. In 2019, HyD and the Hong Kong Productivity Council jointly developed an intelligent robotic system suitable for use on the roads of Hong Kong. The prototype of the system, built with cameras, sensors and robotic arms, is the world's first intelligent robotic system that can recognize its surrounding environment and automatically place and collect traffic cones and lanterns. It is anticipated that the system can help minimise the safety hazard of workers in carrying out maintenance works on the road. HyD is currently carrying out detailed design for the intelligent robotic system for installation on construction vehicles. Upon completion of the detailed design, the system is expected to be put on trial on high speed roads starting from next year.

Streetscape Enhancement and New Environmental Measures

Streetscape Enhancement

12. Since 2017, tying in with their maintenance and renovation programmes, HyD has drawn up thematic designs for selected bridges or subways with high pedestrian flow at prominent locations, to add thereon some featured patterns echoing the uniqueness of the surrounding environment. The designs are drawn up mainly with reference to the natural resources or cultural history of the area with a view to manifesting the characteristics of the area and better integrating the highway structures into the community. For example, the design "Memories in Blossom" in Causeway Bay was inspired by the old trees in the vicinity (see **Annex 1**), the painting in Tin Shui Wai presents the various inhabitants in the area throughout the four seasons as well as day and night. (see **Annex 2**), and the design "Country Delight" in Fanling is originated from the renowned farms in the area (see **Annex 3**).

13. From 2017 to 2020, HyD has carried out beautification works for some 50 bridges and subways. Starting from the end of 2020, HyD has stepped up the implementation works in this regard. Renovation and beautification works for about 200 highway structures and about 10 000 lamp posts were carried out this year, creating about a total of 300 temporary jobs, which help alleviate the unemployment situation in view of the pandemic, in addition to enhancing the streetscape enhancement. HyD will continue to carry out beautification works for highway structures in tandem with the maintenance and renovation programme of its bridges and subways.

Enhancement Programme for Vegetated Slopes

14. There are about 600 000 trees planted on roadside slopes and along expressways maintained by HyD. Ageing trees may collapse due to structural and health problems, posing potential hazards to road users. In this connection, HyD introduced the "Enhancement Programme of Vegetated Slopes" in 2016. Apart from systematic removal of ageing trees and those with structural and health problems, the enhancement programme would also re-plant native and local trees and shrubs in situ to

beautify the roadside landscape and enhance the biodiversity of vegetation. The removed trees would also be recycled and upcycled to produce art works, education as well as construction materials, such that the old trees can be retained in another form to continue their service to the community, putting the concept of sustainable development into practice.

Light Emitting Diode (LED) Public Lighting Replacement Programme

15. In terms of environmental protection, HyD has launched a LED replacement programme since 2017/18 to provide a more energy-efficient, durable and environmentally friendly public lighting system. As there are over 170 000 road lights and fluorescent tubes in footbridges and subways, it is targeted that an average of 6 500 road lights and 1 500 fluorescent tubes in footbridge and subway be replaced with LED luminaires annually. In addition, there are about 4 500 gantry signs and roadside floodlights in Hong Kong and HyD plans to replace all of these 4 500 lightings within five years. HyD will continue to closely keep in view the development of LED luminaires and other lighting technologies to develop a more environmentally friendly and energy-saving public lighting system.

Transport and Housing Bureau
Highways Department
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Annex 1

Memories in Blossom Causeway Bay

The design is inspired by the people's perception of time and space and their nostalgia for the old days - capturing the blossoming moments of the majestic old trees of Delonix regia, Ceiba pentandra and Celtis sinensis near the Victoria Park and the Hong Kong Central Library.

Delonix regia

Ceiba pentandra

Celtis sinensis

Image Source: ArchSD

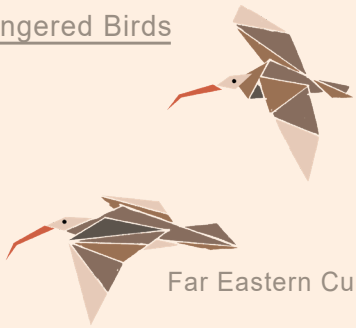
Hide and Seek

Tin Shui Wai

Tin Shui Wai used to have a continuous stretch of fish ponds. The large wetland areas are where saltwater and fresh water meet, in which fish, shrimp, and Malacca galingale (*Cyperus malaccensis*) are found. The wetlands also attract various species of birds including migratory birds, to hunt here.

Visit Tin Shui Wai to look for its biodiversity amidst seasonal change and alternation of day and night.

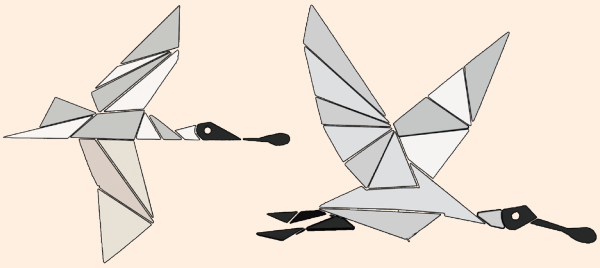
Endangered Birds


Far Eastern Curlew


Imperial Eagle


Butterflies


Fireflies

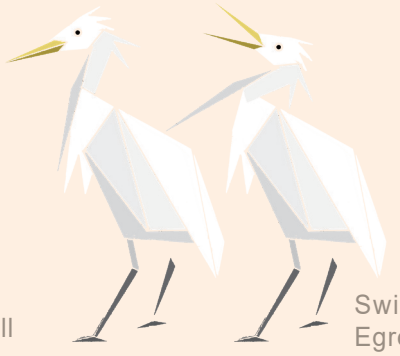

Black-faced Spoonbills


Greater Spotted Eagle


Hakkas fishing and growing Malacca galingale


Dalmatian Pelican


Saunders's Gull


Swinhoe's Egret

Country Delight Fanling

- North District is known for its renowned natural beauty and interesting scenes.
- Little egrets gliding over the peaceful Sha Tau Kok Hoi, the verdant ridges of the A Chau area, the reddish autumn leaves of the Sweet Gum trees and the abundance of ripe tomatoes in organic farms; all these serene natural scenary of the countryside is an interesting contrast to the busy Luen Wo Hui Market.

A Chau, Luk Keng

A small island in the Sha Tau Kok Sea, and is a major habitat for local egrets.

Sweet Gum (*Liquidambar formosana*)

Native deciduous tree common in the countryside. A forest of green in spring will turn to shades of red during autumn.

Four-leaf clover

The majority of White Clover (*Trifolium repens*) is three-leaf. It is believed that finding a four-leaf clover brings good luck.

Organic farm

North District is home to many local organic farms which supply various kinds of healthy food.